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Strategic port pricing

Report by the UNCTAD secretariat

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FOREWORD

This report [1] has been prepared following the recommendation of the UNCTAD *Ad hoc* Intergovernmental Group of Port Experts in 1990 to prepare a study on setting port tariffs, an initiative reiterated by the Intergovernmental Group of Port Experts in 1993. The purpose of this publication is to advise senior port managers, particularly in developing countries, on how to make the best use of the new techniques of port pricing.

In 1975 UNCTAD published the report *Port pricing* [2] which provided guidance for ports in developing countries on establishing a tariff structure and setting tariff levels. While the techniques proposed then are still valid, today more attention must be given to the use of pricing to achieve the strategies defined by the port. Hence, the purpose of the present study is to provide a framework for ministries responsible for transport, port authorities and port managers on how they may use pricing techniques to improve the efficiency and sustainability of ports and related port services. Public port authorities provide services and lease facilities for a range of prices which yield operating revenue for the port. This revenue, together with any subsidy, determines the viability of the port. In general, subsidies are now being reduced or eliminated and so port authorities must depend more on operating revenues. Therefore services are usually priced to generate a profit or at least to break even. For the port authority to be sustainable, it must also generate sufficient revenue to allow it to renew and expand its facilities and equipment as required.

Pricing is a major factor in the implementation of a port's strategic plan. The port management concept may be viewed from three aspects: the port's planning and development philosophy, with its goals or objectives; the port's investment criteria and policies; and the port's pricing policies and techniques. Two basic approaches may be taken to pricing policy: economic or financial. The economic approach argues for marginal cost pricing, taking into consideration the effects on all parties, including benefits derived by others. The financial approach argues for prices to be set on the basis of accounting costs, to recover fixed and variable costs and to provide an adequate rate of return. The latter approach seeks to achieve a profit. Yet another approach used is the public enterprise one which aims to foster local development and economic activities, so as to maximize throughput; it usually requires subsidies (for example to cover part of the fixed cost of infrastructure).

The original report argued the case for the economic approach. The present report subscribes to the same philosophy but argues that more flexibility is desirable in setting prices based on the three critical elements - cost, performance and value - as it is necessary to improve both the financial and operational performance of the port in an environment that is much more competitive than ever before.

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[1] The UNCTAD secretariat wishes to thank Mr John H. Arnold Jr. for his valuable contribution towards the preparation of this report.

[2] *Port pricing*, UNCTAD, TD/B/C.4/110/Rev.1.

I. THE CONCEPT OF STRATEGIC PORT PRICING

1. In the past many ports of developing countries provided services and facilities to shipowners and shippers in a relatively limited competitive environment. Liner shipping was structured in conferences that charged similar freight rates to a number of destinations, sometimes located far apart but within the same range. Inland transport was limited owing to underdeveloped transport networks or to cumbersome import/export procedures. Tramp shipping, and its associated inland transport in bulk, was tied to specific and few import or export industrial sites. For ports, this meant captive cargoes and well-defined hinterlands along with a fair degree of monopoly power over the users of services and facilities. Moreover, these ports were, as a rule, managed by corporate bodies under the tight control exercised by national governments, a control often justified by the need to protect the interest of the public at large not to mention the substantial financial investment in port development schemes.

2. In 1975, when UNCTAD published its report on port pricing, there was concern over how to allocate the benefits derived from port investments among the various interested parties (shippers, shipowners and government) and how to utilize better the expensive ports assets. Thus, the report advocated giving primary consideration to the economic cost rather than the accounting costs in setting port prices. Furthermore, it argued that the focus should be on three elements: costs, to recover expenses incurred by the port in providing services and facilities; utilization, to promote the better use of port assets; and prices structured on what the traffic can bear, to draw a share of the benefits accrued to users, shippers and shipowners using the services and facilities.

The search for competitive advantage

3. Over the past 20 years, competition among ports around the world has increased dramatically, owing to several factors such as the increased competition in liner and tramp shipping, the development of inland transport networks, deregulation of inland transport operators and facilitation of transport procedures. The greatest engine of change has been the unitization of general cargo which now moves in containers or on pallets. The outcome is the predominance of intermodal transport, over sea and land transport, and its reduced costs. Increased competition has forced port managers to give priority to users' needs and to assess their added value received from port services and facilities. This value is related to the increase in value of the cargo as a result of its being moved from its place of origin to its destination.

4. In principle added value can be estimated from the difference between the producer's sales price, which is related to the cost of production, and the consumer's purchase price, which is related to its value to the consumer. Part of this price differential is expected to cover the intermodal transport costs or logistics costs, and provide a return to transport operators. However, in the absence of intermediate points of sale, it is not usually possible to quantify changes in the value of cargo as it moves through each stage of the logistic chain, especially movements through ports.

5. An alternative method is to estimate the increase in value of the cargo by examining the value chains of the port user.[3] These chains consist of distinct value-producing activities, each of which is defined by

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[3] The need to concentrate on value as a method of developing competitive advantage was popularized in the writings of Michael Porter, see *Competitive Advantage: Creating and Sustaining Superior Performance*, 1985, The Free Press. He developed a general concept of a value chain and applied it to the production of goods. The current discussion adapts this concept to the provision of transport or logistics services.

Table 1
The port's value chain

SERVICES TO THE SHIP
- **Safe Navigation**
  - Aids to navigation
  - Dredging
  - Pilotage, towage
- **Services at the Berth**
  - Berthing
  - Stevedoring, wharf handling
  - Equipment, short-term rental
  - Water, bunkers, garbage removal
  - Electricity and communications
  - Stowage planning

SERVICES TO THE CARGO
- **Cargo Processing, Storage**
  - Storage, short-term
  - Storage, long-term
  - Processing to different form
  - Consolidation/deconsolidation
  - Equipment, short-term rental
- **Information Processing**
  - Cargo inventory
  - Notification of vessel and cargo arrival
  - Cargo clearance

OTHER SERVICES TO USERS
- **Leasing land, other resources**
  - Office space
  - Warehouses
  - Equipment, long-term rental
  - Land for development
  - Land for operations
- **Security**
  - Vessels
  - Cargo

OTHER PORT ACTIVITIES
- **Marketing and Sales**
  - Market analysis
  - Marketing activities
- **Human Resource Development**
  - Training
  - Recruitment
  - Reorganization of work and gangs

the value it provides and the costs it incurs. For the shipper, the value-producing activities are the movement, storage and possible intermediate processing of the cargo. The value of these activities is associated with the delivery of the cargo to the buyer in a specific condition and within a specified time. The cost to shippers is associated with the tariffs charged for each service, any losses as a result of cargo movement, the duration of the process and timeliness of delivery. For shipowners and transport operators, the value-producing activities are the collection and distribution of cargoes, the line-haul movement and the intermodal transfers. The value of such activities derives from the increase in value of the cargo when delivered to the buyer at a specific time. Costs include not only the operating and capital costs of vessels and other vehicles but also the opportunity cost of not deploying them for other ends.

6. For the port, the value-producing activities range from basic cargo-handling and storage activities to cargo documentation and cargo tracking. Table 1 provides a detailed breakdown of the value chain of a large port. The value provided to shippers is derived from the transfer of cargo between modes within a given time and in a specified condition. The port may increase this value by reducing the time required to move cargo through the port without loss or damage. The value provided to ship and transport operators derives from the speedy and careful handling of cargo to and from vessels and vehicles within a predictable lapse of time. The port increases this value by reducing the turn--around time of vessels and vehicles and by increasing their security and that of their cargoes. Ports have also sought to extend this value chain by providing other logistics services, such as the coordination of land transport services, inland storage and distribution/collection services.

7. As competition among intermodal routes increases, so too have the efforts of ports to establish a competitive advantage that allows them to remain in business. In the past the geographical location of the port, the depth of the port's navigational channel or the security offered by its harbour were often enough to provide a competitive edge. Today, competitive advantage must be derived from providing better services to vessels and cargoes using the port. This can be accomplished through cost leadership or service differentiation. With the former, the port attempts to become the lowest-cost provider of services or facilities; with the latter, the port seeks to offer services and facilities of superior quality.

Table 2
Sources of competitive advantage

COST LEADERSHIP
- Access to transport routes
- Low and flexible charges
- Fast turnaround
- Integration with other transport
- Economies of scale

DIFFERENTIATION
- Specialized equipment
- Dedicated terminals
- Extended or specialized storage
- Proximity to production and to markets
- Depth of access channel
- Ancillary logistics services
- Freeport / Export Processing Zone

Examples of each are shown in table 2. These strategies aim to provide the users with the lowest transport cost, or best logistics cost, which includes not only the charges paid by them to the port but also their own operating expenses incurred while in port.

Strategic Pricing

8. In ports the significant changes are obviously not only the physical changes, such as the replacement of the berth by the terminal as the operational unit, but also the institutional changes as autonomous corporate bodies, namely port authorities and port operators, are now a standard feature in ports around the world. As explained in a previous report,[4] port authorities are now resorting to strategic planning to survive in a competitive environment through the use of cost leadership and service differentiation, in general, and strategic pricing in particular. Further, these port authorities are improving their managerial capabilities [5] by implementing concepts, such as total quality-control, and relying on management tools, such as port pricing. Perhaps the degree of the impact of competition on these corporate bodies can be measured by the increased reference made to clients instead of users.

9. In general terms, strategic planning can be regarded as a process whereby the corporate body chooses strategies which will emphasize its strengths and pursues market opportunities while protecting itself from market threats and compensating for its weaknesses. This is accomplished primarily by reallocating the available resources and, to a lesser extent, by adding to these resources. The resources include not only facilities and equipment but, equally important, the skill and experience of its management and labour. The implementation of a strategic plan is carried out in the medium term (three to five years) and on the basis of agreed objectives and targets for the corporate body as a whole, each of its departments and its business units. Therefore, there are operational, financial and marketing objectives. Pricing is one of the main tools to be used to achieve these objectives. Accordingly, strategic pricing can be broadly defined as ***the use of pricing as a mechanism for achieving competitive advantage***.

10. The idea of competitive advantage through cost leadership or service differentiation underlies the strategic plans of port authorities. These plans are made up of specific strategies such as improvements in operational efficiency, investment in facilities and equipment, market-oriented pricing or promotion of the port or specific services; they are then subdivided into objectives with quantitative targets. For instance, improving operational efficiency may require achieving such goals as increased handling productivity, reduced users' turn-around time and lower port operating costs; each of these in turn will require assigning targets for each of the departments concerned (for example, an operations department would have to increase the handling rate of containers in fully-cellular containerships to 18 units per hour per crane). Pricing can also contribute to improvements in productivity by a combination of fines and

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[4] *Strategic planning for port authorities*, UNCTAD/SHIP/646.

[5] *The principles of modern port management and organization*, UNCTAD, TD/B/C.4/AC.7/13, chapter III, Port Management.

incentives (for example, imposing a surcharge on vessels occupying a berth but not working or offering rebates to those ships that start work soon after berthing).

11. Again, pricing can be used to generate the funds required for investments in facilities and equipment needed so as to increase the capacity of the port and thus reduce delays and costs to clients waiting for access. Investments in specialized and high-throughput equipment and facilities would allow clients to use larger and specialized ships and vehicles which would reduce turn-around time and costs. Pricing can also be used to discourage competition from other ports by setting charges at cost for existing levels of traffic. This will prevent other ports with lower levels of traffic to charge enough to cover the fixed cost of their facilities. Strategies based on market-oriented pricing improve competitive advantage by equating the port's charges to their value to users. This allows the port to focus on the differential between value provided and the amount charged relative to the differential offered by competing ports. Finally, marketing activities are an important strategy for making potential users aware of the port's competitive advantage, notably where a port is attempting to differentiate by providing specialized services or a wide range of logistics services.

12. Indeed, pricing can be a very useful tool in achieving the objectives and targets of a strategic plan. Use of this tool may not be possible if port charges are controlled by legislation or regulations. There may be cases where monopolistic situations arise and regulatory restraints on a port's freedom of charging would be necessary. This being said, in various parts of the world many ports are facing increased competition because of technological change in shipping, ports and land transport which may require a relaxation of government control on port charges. Sometimes an aggressive pricing policy can take advantage of opportunities by lowering charges so as to expand market share and open up new markets or encourage the use of under-utilized facilities and by increasing charges to generate additional revenues in markets where there is limited competition or to improve the capacity of heavily used facilities by discouraging their inefficient use. A defensive pricing policy can protect against specific market threats, by lowering charges to maintain market share in highly competitive markets and by increasing charges to reduce demand in undesirable markets.

II. PORT PRICING IN A COMPETITIVE ENVIRONMENT

13. Pricing in the context of ports has given rise to specialized terminology [6] of which the basic elements are port dues and specific port tariffs. Port dues are charges to users for the use of the general port services and facilities, specific tariffs are charges paid by users for specific and clearly identified services. As major users are identified with both ships and cargoes, another useful distinction is to split dues and specific port tariffs into two, those applied to ships and cargoes respectively. In this report, port charges will refer to both port dues and specific tariffs, although the general term tariff is sometimes also used to refer to both.

14. The provision of services and facilities in a port can be carried out by a single corporate body, namely the port authority, or by several entities such as, the port authority and one or several port operators, with the operators mostly in charge of the provision of marine or cargo-related services. Accordingly, port pricing can refer either to the tariff of the port authority or the set of tariffs charged

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[6] *Port pricing*, UNCTAD, TD/B/C.4/110/Rev.1, paragraphs 61 to 94 give the findings of a survey of 55 ports made in the early 1970's and show the diversity of the charges.

by the port authority and the port operators. With the trend for port authorities to become landlord authorities, the latter type of port pricing is becoming more current, with port operators charging specific port tariffs for services while port authorities charge specific port tariffs for facilities and port dues. Thus, the structure of port authority tariffs, that is, the way charges are grouped, has been modified. Some of the tariff items are now contained in the tariffs of port operators. Further, the previously limited leases of land and facilities to port operators have grown and become an important source of revenue. In general, competition has forced tariff levels (the amount actually charged) to become more flexible.

Objectives and constraints of port pricing

15. The tariff structure and level of the tariff of a port authority reflects, on one side, the duties imposed by law and, on the other, the constraints and objectives identified by its management in view of the competitive environment in which the port functions. In certain ports in some countries, the practice may be for the national, regional or municipal government to provide or subsidize the cost of the development and maintenance of some infrastructure, for example access channels, and this will affect the level of port authority charges. Port operators are limited only by commercial constraints and objectives within the framework of their contractual relationship with the port authority and the competitive conditions prevailing in respect of their activities.

16. By-laws or regulations may well be a source of competitive advantage for a port authority. Subsidies to ports, which are decided by the country in which the port is located, are one example. A recurrent argument favours subsidies where ports provide a public service. In the past, UNCTAD [7] warned against subsidies for ports on the grounds that they may lead to inefficient functioning if management is not encouraged to perform or users are tempted to use the assets uneconomically. The position of a number of countries on this issue has been spelled out in various articles and publications.[8] A related subject, which had also been raised earlier by UNCTAD, is the aim to keep the benefits of port investment within the country concerned. This view should now be considered again in the wider perspective of the competitive position of the country.

17. The position of port operators is related to business in general. As a rule businesses do not receive subsidies; the recovery of investments made, along with an acceptable rate of return, is determined by the market. Both elements are considered part of the commercial risk. Some investments will earn in excess of their expected return while others may never recover more than their operating costs. In fact, recovery of investment spans the evolution of a business. Typically, a new business may have an initial period of rapid growth followed by slower growth, then stabilization and, finally, decline. A common strategy is to keep prices low during the initial period to encourage a rapid build-up of demand [9]. The revenues then will be sufficient to cover the operating costs but will recover only a part of the investment. Once the business has grown and steadied, prices can be increased but not so much as to choke off the growth or divert demand to competitors. Revenues during this period should cover operating costs and provide a reasonable return on investment. As growth in demand or market share stabilizes, prices can again be increased to take advantage of client loyalty. Finally, when the demand and/or market share begins to decline, the business may need lower its prices in order to stretch out the period of decline so

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[7] *Ibid.*, paragraphs 57 to 59.

[8] See for example the special issue of Maritime Policy and Management, Volume 15, No 2, 1986.

[9] The exception occurs when there is a large pent-up demand. In this case, all costs may be covered from the beginning.

as to achieve better utilization of its resources, or it may increase prices to speed the decline, so that the resources can be reallocated. In this period, revenues should cover operating costs and yield some return on the investment.

18. One difficulty with accepting this approach in ports is the concern for the equal treatment of port users. This concern underlies the concept of ports as providers of a public service. In effect, users normally do not pay their "fair share" at the early stages of the investment while possibly bearing heavy charges at the mature stages. Similar objections could be raised against cross-subsidies, whereby revenues accruing from one service contribute towards costs of supporting another one. In answer to these objections a tariff may be set for a service that reflects the costs allocated to it. In practice, as port managers well know, this aim is difficult if not impossible to achieve, because a large portion of expenditures of a port authority, or port operator, are of a general nature and must be allocated arbitrarily; therefore, expenses could be recovered from many combinations of revenues coming from a variety of services. In fact, managers often settle for the overall consideration that revenues equal expenses, including a return on the investment in the case of purely commercial activities like those of port operators.

19. The constraints facing management when setting tariffs are many and they impose a "floor" to the tariff level. The "floor" for the overall level of a port authority tariff is lowered by a decision to allow subsidies, while a decision to support other weaker ports or activities will raise it. Similar reasoning applies to individual tariff items, namely the decision to recover only part of the costs incurred in the provision of a service will lower the "floor" while the decision to recover all costs incurred in the provision of that service or to contribute to the expenses incurred in the provision of other services will raise it. Moreover, the willingness of users to pay, sets a "ceiling" on the tariff level. Management should assess both the "floor" and the "ceiling" for the whole tariff and for individual tariff items, fixing the actual level somewhat in between these parameters so that the port authority achieves its strategic objectives.

The CPV approach

20. Port authorities' revenue is obtained from the charges set and, increasingly, from leases of land and facilities to industrial users and operators. There is a substantial difference between the two sources of revenue as the latter requires the valuation of port assets, often with consideration of the long term outlook and tendering or similar procedures. Further, as the structure and level of the authority's charges are usually among the first factors to consider in deciding the leasing conditions, such charges are paramount to assessing revenues. Charges can be divided into three groups. In the first group are those related to the provision of services set out on the basis of the **costs**, such as for stevedoring. In the second group are those tariffs related to the provision of facilities, such as a berth or a silo. In the past, in setting this tariff the aim was to achieve a better utilization of the facilities; in the present competitive environment, the focus has shifted onto the **performance** which it allows the other links of the logistics chain to attain. Finally, in the third group are general tariffs items, namely port dues, which were formerly set by considering the rule of what-the-traffic-could-bear, but which now, can be better assessed by the **value** that users attach to them and, on this account, are called value-based tariffs. Tariffs items in the latter group are expected to contribute most to recovering overall expenses, including a return on investments. This grouping of port tariffs is called the CPV approach because it includes three elements, costs (C), performance (P) and value (V). The merit of this new approach is that it helps the port authority use pricing as an effective tool in achieving its objectives in a competitive environment.

21. Even at the time of limited competition between ports, there was resort to tariff comparisons by governments, in their regulatory function, and by ports, to fend off users' complaints. In this approach, a port identifies other ports with similar characteristics within the region and then compares its published tariffs with those of the "comparable" ports. In some regions, this exercise has led to the adoption of common tariff structures and their charging units, and occasionally to reduced tariff level differentials.

22. However, tariffs comparisons pose serious shortcomings. The strategy is rarely a suitable tool to gain competitive advantage. In effect, the underlying assumptions, namely that the charges being compared are for the same services and that ports being compared are competing for the same traffic, are seldom realistic. Different services may be bundled under the same charge; the mix of labour and capital employed in providing the same service may differ widely; moreover the quality of services may not be comparable. Although vessels and cargoes in ports may be similar, their competitiveness differs as does their ability to support charges. Even the more detailed study of tariffs made by port authorities, by preparing sample ship's bills [10] for comparable ports based on typical vessel sizes, commodities and amounts of cargo transferred per vessel call, does not improve the comparison because it ignores important elements such as charges by port operators (i.e. for stevedoring) and the relative cost to the user owing to differences in the quality of facilities and services provided (e.g. average ship turn-around time).

23. An advantage of tariff comparisons is that it allows ports to appear to be competitive. It can show how tariffs are "reasonable" or, more importantly, that a proposed increase in the level would bring it in line with competitors. Furthermore, tariff comparisons provide useful marketing information. Thus, relatively small differences in level, say up to ± 10 per cent, may have relatively little impact on competitive advantage but greater disparities may make it necessary to determine whether the cause is a difference in costs or in demand.

24. Differences in costs may occur because of lack of cost control, ineffective assignment and supervision of labour, or intractable problems such as rigid dockworker schemes, chronic over-staffing, restrictive work practices, high wages and inappropriate investments. Differences in demand are those that link differences in port charges with the relative shares in competing markets. For instance, situations in which the port has higher charges but maintains a significant market share imply that difference in other logistics costs are more important than port charges.

The process of tariff revision

25. The most common situation facing a port authority is the revision of its tariff in response to specific problems, such as a deteriorating financial situation, changing uses of the port facilities and increasing competition. The revision calls for a two-pronged effort, one directed inside the authority, the other outside. The inside effort may be guided by a combination of financial, operational or commercial objectives related to the problems facing the authority, a sample of these objectives are shown in table 3. The outside effort would focus on users and regulatory bodies such as national or regional governments.

26. The scope of the revision, which could range from a simple adjustment of the level of selected items to an overall review of the structure and level of tariffs, will dictate the scope of the inside and outside effort. The following points need to be considered in relation to the ***inside effort***: (i) the organizational

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[10] The preparation of sample bills is difficult; programmes, such as the *Port Tariff Evaluation: a Structured Approach*, from the World Bank, Infrastructure Division, IBRD, 1987, are available to assist in this. However, the collection of data remains a problem.

structure; (ii) the departments to involve; (iii) the time and expertise required; (iv) the leadership; (v) the information to be collected and analyzed.

27. The establishment of a separate tariff unit within the accounting department, fully responsible for tariff revision, is rarely effective, first because major revisions are infrequent and secondly because they require a broad managerial perspective. An alternative is to have a standing committee on tariffs which meets regularly to review adjustments in levels. This offers an advantage in that members gain experience with the price sensitivity of users, a useful input for more extensive tariff revisions. Such a committee should include managers from Operations, Marketing, Accounting and Finance. Ideally, the revision should stem from semi-annual reviews, elucidating the competitive position and financial condition of the authority and its financial objectives. For port operators working in a more commercial environment with freedom to set prices between limits, a senior manager might have authority to set a price to gain new traffic or to save existing business.

Table 3
Principal objectives

- COMMERCIAL
  - Increase market share in selected markets
  - Maintain market share in other markets
- PERFORMANCE
  - Enhance performance at congested facilities
  - Encourage more efficient use of facilities
  - Equate tariff rates with direct costs
- FINANCIAL
  - Equate the charges for individual businesses with their stand-alone costs
  - Generate additional revenues to
    - Meet current cash flow requirements
    - Fund future investments
    - Produce an acceptable return for investors
    - Satisfy mandated financial performance criteria

28. The participation of different departments is essential in the tariff revision process. For instance, the Marketing Department would determine the effect of the proposed changes on user behaviour and overall demand and estimate future cargo flows and traffic levels. The Operations Department would estimate actual and forecasted performance indicators for the facilities and services for which efficiency improvements are sought. The Finance Department would be responsible for setting up revenue target consistent with the financial objectives of paying debts, making up reserves for expansions, etc. The Accounting Department would determine the cost and revenue projections for individual port services.

29. The time required for a revision of tariffs increases with the number of tariff items under review and their complexity. For example, the towage tariff is relatively easy to revise, whereas the wharfage tariff is extremely difficult. Revision of tariff levels can be accomplished in a matter of weeks, but those of the tariff structure usually require months by a specialized team with seconded staff. Other factors to take into account are the size of the proposed increase in revenues, the number of port activities and the market segments from which additional revenue will be generated. The available expertise of the existing staff could be strengthened with consultancy services or contract research. There is seldom justification for recruiting additional staff or providing extensive training to existing staff for the process of tariff revision. However, the recruitment of personnel skilled in market research and financial planning, along with training in operational analysis and demand forecasting, for the operations and accounting staff, will yield benefits to the port authority in general as well as improve the tariff revision process.

30. Leadership for the process of tariff revision is a critical factor. It determines not only the importance given to the process but also ensures that the different departments of the authority coordinate their work to achieve the overall objectives because factors and issues do extend across departmental lines. A senior and charismatic manager should be appointed to this task by the standing committee.

Table 4
Concerns of participants

- PUBLIC SERVICE - GENERAL MANAGER
  - Over-investment
  - Insufficient competition
  - Destructive competition
- COMPETITION - GENERAL MANAGER, MARKETING MANAGER
  - Volume of cargoes
  - Calls by shipping lines
  - Market share
- EFFICIENCY - OPERATIONS MANAGER
  - Productivity and resources
  - Occupancy and delays
- SUSTAINABILITY - FINANCE MANAGER
  - Cash flow requirements
  - Rate of return on investment
- COST RECOVERY - UNIT MANAGER
  - Direct versus indirect costs
  - Variable costs

The manager's efforts will have a bearing not only within the authority but outside it. Data collection and analysis are key components of the revision process. The involvement of relevant departments is critical, the coordination task is simplified when individual managers or department heads focus on the concerns shown in table 4. Summaries and position papers could be prepared by the departments concerned or by sub-committees or ad hoc task forces. A checklist of tasks for establishing a new tariff is given in the annex.

31. However effective the inside effort of the port authority in revising its tariff, if a comparable ***outside effort*** is not made, the result will be disappointing. In effect, for the tariff revision, a public port may need to obtain a formal approval from government. This could mean making submissions not only to the relevant ministry but also to the parliament. Moreover, the port authority must obtain tacit approval from its users. This does not mean that users need to be in agreement with changes in tariffs, but rather that they should be aware of the changes and have had an opportunity to present their views. Communication and cooperation are essential for maintaining the port's market share in the face of any tariff increases and for building user confidence that changes being introduced are neither sudden nor inflexible.

32. Submission of a draft tariff will probably cause government concern that increases may have an inflationary impact on the economy through the passing on to consumers of cost increases for port and other transport-related services. The public service approach to ports in many countries leads to cost-related tariffs to comply with regulations. This hinders tariff changes which are commercially-oriented. It may even preclude increases intended to fund port improvements. However, there is one strong argument to counter such concerns, namely the need to generate sufficient revenues to cover actual costs. Today, as governments are increasingly confronted with shortfalls in tax revenues, the need to reduce both operating and capital subsidies has weakened opposition to increases in port tariffs. In all cases, it is important to demonstrate efforts to control costs and maintain financial autonomy. The support of users is often helpful in obtaining government approval.

33. Consultations with users should begin as soon as a provisional set of tariffs has been prepared and reviewed by the standing committee. A document with the proposed changes needs to be prepared as well as a strategy for presenting the changes to users. In particular, management must persuade the users that the changes will offer benefits to them. The worst approach would be to state that the tariff changes are necessary to meet rising costs because this asks the user to pay more for the same service. General inflation, rising labour costs and currency devaluation are of course reasons for adjustments in tariffs but they are not sufficient because users also experience them in their own businesses but are prevented by competition from simply passing on cost increases to their clients.

34. The best argument for a tariff increase is that the revenues are needed to fund improvements in quality, such as the deepening of an access channel or commissioning of modern equipment. If the tariff change involves a shift in the sources of revenue from one tariff category to another, then it is necessary to demonstrate that the total charges will not climb significantly and that the users will have an opportunity to moderate any increases in the specific tariffs by changing their operating procedures. Increases in value-based tariffs can be presented as a means for ensuring that the port can continue to provide an acceptable quality of service to its most valued customers while still provide access to all members of the shipping community. The reactions to any proposed revision of tariffs will provide an understanding of user's sensitivity to changes in price.[11] The interaction with major users, such as shipping lines and shippers, should begin relatively early in the design process, but the involvement of other users can occur later in the process when making presentations to trade associations. General meetings will solicit the support of the broader community and avoid the disinformation problems which result when special interests groups seek to organize opposition to changes that have not been fully explained. While one goal is to limit organized opposition, a more ambitious goal is to obtain the support, albeit tacit, of the port community.[12]

35. The support of users may require some compromise, therefore some negotiating flexibility should be built into a draft tariff revision. The port management should have a number of options so that critical revisions can be separated from the less critical changes. Expenditure calculations in certain areas should be based on conservative estimates so that cost reductions can be achieved even if all of the proposed increases are not approved. Increases could be phased in over a period of time to allow users to change their pattern of operation and adjust their own prices, increases could be reduced for those users which are most sensitive to changes in price, etc. Tariff revision thus begins as an analytical effort but ends in negotiated compromise. The negotiation of a tariff acceptable to both the port and its users requires a clear understanding of the port's objectives and strategies. Negotiators must have the authority to make the necessary compromises. For this reason, the chief executive officer of the port should take the lead in these negotiations. Any delegation of this responsibility will raise questions as to the importance of the proposed revisions and the willingness of the port to consult actively with its users. However, the presentation of the proposed tariff revision to the port community is a public relations effort and should be guided by those on the port staff most adept at communicating with the public.

36. A summary of the sequence of events to be followed in presenting the tariff to users appears in table 5. The art of presenting the tariff revisions to the public is just that, an art. Port managements often lack the public relations skills necessary to make a successful presentation or to undertake the negotiations needed to achieve acceptance of appropriate tariffs or tariff changes. This does not mean that they are not aware of the concerns of port users, merely that they have difficulty in presenting this information. One way to develop skills in this area is through training and practice in role playing.

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[11] The reactions of the users need not be taken at face value. As a general rule, the port users are the first to complain about price increases and the last to be satisfied with the efforts to improve port services. Nevertheless, experienced port managers learn to separate serious concerns from complaints (in much the same way a mother learns to differentiate the cries of pain from the cries for greater attention).

[12] See *Port marketing and the challenge of the third generation port*, UNCTAD (TD/B/C.4/AC.7/14), paragraphs 187 to 196, which explains the concept of port community.

Table 5
Presentation of the tariff

- The tariff presentation is to be treated as a public relations effort
- Present the tariff first to the shipping community and then to Government
- Emphasize benefits to be produced and complementary improvements to be introduced
- Allow for concessions in subsequent discussion
- Allow for trade-offs between tariff categories

37. Ports providing services to the owners of vessels and cargo require different sets of traffic categories for their tariffs. However, it is perfectly possible - and highly desirable - even for such ports to impose charges which are simple in structure, well set out, comprehensive and easy to apply. The existence of such port tariffs is a trademark of a modern port with a good, positive market-driven understanding of its clients and their requirements.[13]

38. Port facilities in different ports within a country may differ widely in their utilization and indeed in their potential competitive strength. Thus, it would not be desirable for port charges to be standardized, as this could make it harder to achieve optimum utilization of all port facilities. Furthermore, competition is widely seen as a stimulus to efficiency even within the public sector, and so for purposes of real competition, it may be desirable that ports within a country are not required to charge on a wholly uniform basis.

III. THE PRACTICE OF STRATEGIC PORT PRICING

39. The cost, performance, value or CPV approach allows port managers through tariffs to accomplish different sets of objectives. The cost-based tariffs are used to achieve the marketing objective of maximizing the use of port services and the financial objective of covering the variable costs of these services. Performance-based tariffs are used to achieve first, the operational objective of maximizing the throughput of port facilities while limiting the level of congestion experienced by users and secondly, the marketing objective of minimizing the loss of traffic owing to congestion. The value-based tariffs are used to meet the financial objective of generating sufficient revenues to cover the ports' costs and the marketing objective of limiting the loss of traffic as a result of generating these revenues.

40. The CPV approach also allows a more flexible view of the limits to pricing. The "floor", or minimum limit, means that the port authority ***must not charge*** less than the incremental cost it incurs in serving the user while the "ceiling", or maximum limit, means that the port ***cannot charge*** more than the value received by the user. Both can be changed through actions of the port authority or operators. The "floor" can be lowered through increased productivity in the provision of a service, owing to more efficient allocation of resources and procurement of more efficient resources. The "ceiling" can be raised by providing additional capacity of the facilities that will lower congestion. In general, improvements in the quality of services raise both the "floor" and the "ceiling" as the increase of the value to the user of the service or facility, is often accompanied by an increase in the cost of providing those services or facilities. The economic environment can also cause these boundaries to shift. An increase in competition can lower the "ceiling" by reducing the profitability of a trade or by providing alternative lower-cost routes and ports. Inflation and changes in currency exchange rates can modify the boundaries through changes in the marginal costs of resources being deployed or the value of commodities being shipped.

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[13] *Ibid.*, pages 43 and 44, with extracts from the 1990 Tariff Book for the Port of Singapore Authority.

41. The actual tariff level lies between the two boundaries and, through the number of users, determines the level of demand for the services and facilities. In effect, the last user, also called the marginal user, is the one who receives a service, or uses a facility, which he values just equal to the price he pays for it. In so doing he takes into consideration the quality of the service and the turn-around time. The rationale for fixing the price should, therefore, take into account the incremental cost incurred by the port authority, or operator, to serve the marginal user which increases with the use of the service and facility, and is in turn determined by the price charged. Therefore, if the price falls below that incremental cost, then it must be increased so that the demand and the incremental cost are lowered.

42. This reasoning can be followed for each tariff item by employing one of the three elements of the CPV approach. The selection of the element appropriate for each tariff item may be determined by examining the tariff structure and the function, level and charging unit of each tariff category or item. The structure of the principal items is shown in table 6 while the preferred element of the CPV approach is shown in table 7. In table 7 it is considered that general tariffs cover fixed costs; otherwise cost-based tariffs must cover both fixed and variable costs.

Cost-based pricing

43. This has been the traditional approach to pricing. A price is fixed on the basis of the costs incurred in providing the services or facilities. This approach is also used by governments in regulating the port sector. However, the price so obtained is not fixed as there are different costs [14] that can be taken into consideration. For the purpose of this report, three types of costs are deemed relevant. First, there are the fixed costs, that is those which cannot be avoided whether or not the service or facility is used. This is the case for instance with regard to the interest and principal to pay back a loan taken to purchase a quay side crane. Secondly, there is the variable cost of a service or facility, that is the part of the cost which is avoided if the service or facility is not used. For instance, the cost of electricity to operate electric cranes is saved if the cranes are not used. Thirdly there is the marginal cost of a service or facility, that is the extra cost incurred in providing a given service or facility for an additional time to the period originally intended. For instance, if electricity expenses for cranes are composed up of a daily start-up rate plus an hourly rate, the marginal cost corresponding to the use of cranes for one additional hour after an 8-hour shift will be that hourly rate. The variable cost, in that 8-hour shift, will be the hourly rate plus one-eighth of the start-up rate.

44. The definition of costs can depend on the period under consideration. Thus, capital costs are usually considered fixed because they vary only over the long term. Similarly, costs of permanent staff are considered fixed because they change only over the medium term. Both variable and marginal costs are associated with daily, weekly or monthly changes, that is the short term. Further, for pricing purposes, these costs need to be referred to the output, i.e. number of ships berthed, number of tonnes handled, etc., which means taking into consideration the demand for the services and the facilities.

45. Average cost pricing is based on adding the total fixed and variable costs and dividing this sum by the projected demand for the service and the facilities. Port tariffs so derived have the advantage of helping assure that the revenues collected will equal the total expenses, assuming that the projected demand is realized. This implies giving priority to achieving an overall financial target, namely a stand-alone, non-subsidized price. For ports, with their high proportion of fixed-costs, increasing the

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[14] For a definition of costs with examples for the ports sector see paragraphs 166 to 171 in *Port pricing*, UNCTAD, TD/B/C.4/110/Rev.1.

Table 6
Form of different tariff categories

GENERAL TARIFFS

Conservancy, port dues
Charging unit - Vessel GRT, NRT, Length*Beam*Draft
Differentiation - Type of vessel
Wharfage
Charging unit - Freight or metric ton,cubic metre,TEU
Differentiation - Type of commodity

FACILITIES TARIFFS

Berth Hire
Charging unit - Metre-hour, Berth-hour, Berth-day
Differentiation - Type of berth
Transit Storage (short term)
Charging Unit - Day
Differentiation - Open or closed storage, days in storage

SERVICE TARIFFS

Pilotage
Charging unit - Vessel movement
Differentiation -
Towage
Charging unit - Vessel movement
Differentiation - Vessel GRT, NRT, Length*Beam*Draft
Berthing/Unberthing, Mooring
Charging unit - Vessel movement
Differentiation - Vessel GRT, NRT, Length*Beam*Draft
Stevedoring, Wharf-Handling, Receiving/Delivery
Charging unit - Freight ton, metric ton, cubic metre, TEU, Box
Differentiation - Form of cargo
Equipment Hire
Charging unit - Half-hour, hour, shift, half-day
Differentiation - Type of equipment
Cargo Processing
Charging unit - Freight ton, metric ton, cubic Metre
Differentiation - Form of cargo before and after
Warehousing (long term)
Charging unit - Week, month
Differentiation - Type of storage (open, closed, frozen)
Fuel, Utilities
Charging unit - Kwh, metric ton, cubic metre
Differentiation - Capacity provided

throughput where possible may significantly decrease the average or per unit cost. A disadvantage is that there is a tendency to set prices higher when demand is weak and lower prices when demand is strong. Furthermore, this approach excludes those clients that cannot afford to pay a given price but might be able to pay a lower one, perhaps one based only on the variable cost. Pricing based on the unit variable cost is determined by dividing the total variable costs by the projected demand for the services and the facilities. This approach is generally limited to those activities with high variable costs because of the use of casual labour or a large input of energy and materials. Finally, pricing based on the unit marginal cost is determined by dividing the marginal costs by the projected marginal demand for the services and the facilities.

46. The movement of cargo between vessels and land transport vehicles is a good example to take in this regard, as it involves a mix of fixed and variable costs. Most costs related to infrastructure are fixed and include the capital costs and also the maintenance costs owing to normal deterioration by exposure to the elements or wear and tear during operation. The latter is categorized as fixed to simplify the accounting. These maintenance costs include both materials and labour and contracts made with third parties. Utilities are also treated as fixed costs, unless they are explicitly related to the activity on the berth, i.e. power for crane operations, or sold to vessels (electricity and water). Capital cost of equipment, salaries and benefits of permanent staff, and administrative expenses are also considered in this category. Variable costs include: expenditures on fuel, lubricants, and other consumables used in the operation of equipment; expenditures on scheduled maintenance and repairs related to equipment use; payments for equipment rented on a daily or weekly basis; the wages of casual labour hired on a daily or shift basis; and overtime of permanent staff. Table 8 gives an example of the calculation of the average and the variable unit costs for the volume of cargo handled over six months in a container terminal.

Table 7
Function of different tariff categories

GENERAL TARIFFS

Conservancy, port dues
- **Value-based,** corresponding to the value of the vessel (type and size)
- Produce revenues to pay for waterside infrastructure, floating equipment and administration

Wharfage
- **Value-based** corresponding to the value of the cargo
- Produce revenues to pay for wharves and land-side infrastructure, equipment and administration

FACILITIES TARIFFS

Berth hire
- **Performance-based** to encourage vessels to reduce time at berths, especially during periods of congestion, or at under-utilized berths, to attract vessels

Transit storage
- **Performance-based** to encourage consignees to transfer in-bound cleared cargo to other storage areas and to encourage shippers to store cargo in preparation for loading

SERVICE TARIFFS

Pilotage
- **Cost-based** to cover the variable costs of pilots and the pilot boats

Towage
- **Cost-based** to cover the variable costs of tugboats and crew

Berthing/unberthing, mooring
- **Cost-based** to cover the variable cost of the gangs

Stevedoring, wharf-handling, receiving/delivery
- **Cost-based** tariff to cover the variable costs for the cargo-handling labour and equipment

Equipment hire
- **Cost-based** to cover the fixed and variable costs for the equipment and its operators

Cargo processing (including consolidation / deconsolidation)
- **Cost-based** to cover the variable costs for the cargo-handling labour and equipment

Warehousing
- **Value-based** corresponding to price of private service warehousing located outside of the port

Fuel, utilities
- **Cost-based** to cover the direct cost for the amount consumed

47. According to this hypothetical model, a price based on the average cost of US$ 52.77 per TEU would cover all expenses incurred in running a terminal provided that the throughput was at least 38 500 TEUs during the six-month period. A price based on the unit variable cost of US$ 3.44 per TEU would surely attract more customers in view of the considerable price differential in relation to the former price but would not produce revenues commensurate with expenses. However, if charges for marginal business were set sufficiently high to also make some contribution towards fixed costs, this could even reduce the charges to the original clients. Thus it can be advantageous for all users if the port attracts additional

Table 8
Example of calculation of costs for container handling services

Category of cost	Partial costs	Total costs
Fixed costs		
Depreciation of structures/equipment	1 200 000	
Maintenance of structures	20 500	
Utilities	2 500	
Insurance	65 000	
Miscellaneous	17 500	
Overheads	268 875	
Salaries, permanent staff	250 000	
Contracted services	75 000	
Total fixed costs		1 899 375
Variable costs		
Fuel and lubricants	15 500	
Maintenance of equipment	61 000	
Salaries, casual labour	30 500	
Overtime of staff	25 500	
Total variable cost		132 500
Total costs (US$)		2 031 875
Estimated throughput (TEUs for 6 months)		38 500
Average cost (US$/TEU)		52.77
Unit variable cost (US$/TEU)		3.44

marginal business provided such a increase makes some contribution to fixed costs. In general, pricing based on unit variable costs is only appropriate where variable costs are a large share of the total costs, as in labour-intensive break-bulk cargo handling operations. Further, the price based on the unit marginal cost is not significantly different from US$ 3.44 per TEU and in practice this is used as a proxy. However, there are reasons to believe that this is so only if the actual throughput is not very different from the one estimated.

48. In effect, the unit marginal cost is likely to increase with the increase in throughput because there may be a shortage of equipment and labour in the face of increased demand. Available equipment will be used more intensively and probably scheduled maintenance will be deferred, causing more rapid deterioration of equipment, escalating costs of repairs and, eventually, of overhauls. Additionally, the container terminal operator may decide to use equipment which is less suited to the task or to rent equipment at a higher cost. A shortage in labour is relatively rare but can occur when special skills, such as crane operators, are in short supply. More often, when traffic increases, available labour will work overtime on a continuous basis and their productivity will decline. Again, this will increase the unit variable costs and marginal costs.

49. The above observations suggest that a price based on the unit marginal cost requires that the relationship between variable costs and expected through-put demand be known for the period during which the price will prevail. Therefore, it is necessary to estimate the change in resource

productivity as demand increases. This information is difficult and time-consuming to obtain from existing accounting data. Change in variable costs over a long period of time must be correlated with variations in demand. These inherent problems have led to unit marginal costs not being used to set port tariffs, except where explicit surcharges have been introduced to cover overtime, a third shift, or holiday premiums for labour. Another reason that militates against their use is that the period for procurement and recruitment needed to resolve shortages of equipment and labour, respectively, is normally shorter than the period between tariff revisions; hence any increased costs will not be reflected in the tariff. If the cost of the additional equipment and labour is included, then the unit marginal cost is similar to the average cost because it covers a part of the fixed costs.

50. The use of unit marginal costs for setting the level of port charges of seasonal traffic is feasible, however, because it is not efficient to provide additional capacity for these relatively short periods. Furthermore, there is a tariff ceiling, which is determined by the degree of congestion of the facilities as users face much higher operating costs than the actual charge applied by the port authority or operator.

51. The pricing practices of port authorities and operators tend to rely on the average cost. This is consistent with reactive behaviour of these bodies and their focus on insuring adequate revenues while not discouraging existing traffic. Also, port authorities are often regarded as domestic monopolies; their regulation is based on tariffs artificially equated with accounting costs. The concern has been to link prices to accounting costs rather than to efficiency gains or value of services to clients, thus surrendering the setting of tariffs to the accountants.

52. Tariffs based only on variable costs have generally not been introduced even though they encourage efficient use of port resources. One reason is that many port services and facilities have variable costs which are too small to serve as the basis for a tariff. Another, more important reason is that the revenues from tariffs based on variable costs are much less than the port's expenditures. This implies that other tariffs are needed to offset the losses incurred if the tariff applied is one based on variable costs. However, strategic pricing holds that a tariff based on variable costs can achieve the operational objective of maximizing the use of services and the financial objective of covering the variable costs of these services. Obviously, costs not recovered in this way must be recovered in other ways, in particular by using value-based tariffs.

53. Some tariff items, amenable to an approach based on unit variable cost are: pilotage, covering only the variable costs of pilots and pilots boats; towage, covering the variable cost of tugboats and crew; berthing/unberthing and mooring, covering only the variable cost of the gangs; and, stevedoring and cargo handling, covering the variable cost of the equipment and labour involved.

54. For pilotage, there is no change in variable costs for different sized of vessels, so the appropriate charging unit is simply the vessel's port call.[15] The unit of differentiation can be the location where the pilotage starts and ends. For towage, the variable costs increase with the size of the tugboat used and the period of use. The former can be used as the unit of differentiation and the latter as the charging unit. Alternatively, the unit of differentiation can be based on vessel type and size while the charging unit can be a flat movement charge. The fixed cost for tugboats, pilot boats and crews can be covered through a value-based tariff such as port dues. Towage tariffs which are based on vessel length or size

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[15] Some port authorities argue that the variable cost is the risk associated with the value of the vessel being piloted. However, the liability remains with the vessel's captain, so this is not a valid argument.

appear to reflect the cost for tugboat operations but are actually value-based tariffs which discriminate among vessels according to their earning capacity.

55. For stevedoring, the charging unit for equipment is the period of time during which equipment is rented or the amount of cargo handled. For the former, the units of differentiation distinguish among the different types of equipment and their capacities. For the latter, they distinguish among the different forms of cargo. Similarly, for labour, the appropriate charging unit is the number of gang shifts used or the amount of cargo handled. For the former, the unit of differentiation identifies the type of shift based on the premium charge, e.g. regular, second and third shift, weekends, holidays. For the latter, it would identify the form of the cargo, which is related to the labour productivity. Again, the fixed costs for equipment and labour are covered by value-based tariffs, whether specific wharfage tariffs or port dues.

Performance-based pricing

56. Performance-based pricing promotes efficient behaviour of the users of a facility. This is accomplished by using the facility optimally, a level which takes into consideration both the time the facility is used and the time the users queue to use it. On this account, an optimum is sought for this link of the transport chain as it equates the interest of the supplier of the facility with its users.

57. A familiar problem to port managers illustrates this common interest. It is well known that a shortage of properly equipped berths increases the average time vessels wait for a berth and lengthens the time at berth, thus increasing the vessel operators' costs. The answer of port planners normally is to determine the optimal number of berths by balancing the occupancy rate of berths which minimize the total cost of ship time in port with the cost of providing that number of berths. For a single berth this method leads to occupancy rates of say 50 per cent for general cargo ships and less than 40 per cent for modern, more expensive containerships. This calculation shows first, that the optimum is achieved at a rate of occupancy which is less than the full occupancy of the facility and secondly that the optimum rate of occupancy decreases with an increase in the cost of delays experienced by users. Actual calculations of optimum occupancy rates are not easy to carry out for all assets, owing to the lack of data and the mathematics involved.[16] However, the following rough rules apply: (i) decrease the tariff when the level of utilization is below the optimum; and (ii) increase the tariff when the level of utilization is above the optimum. Changes in the tariff level should be made by experienced managers with an in-depth knowledge of the operating and commercial features of the assets. The effectiveness of these adjustments will depend on the quality of the assessment and on what operating and commercial conditions prevail.

58. The rules are applicable at levels of utilization of assets that cannot be regarded as too low or too high. When the level of utilization is well below the optimum level, priority should be given to building up trade and, given that the variable cost for these assets is normally very low, performance-based pricing results in a price that reflects variable or marginal costs. This implies that the cost of the facility is also recovered through other tariffs, or perhaps a subsidy, and that the price will be fixed at a very low level.[17] The latter will encourage undesirable behaviour by users that may be difficult to correct in the

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[16] See, for example, tables VIII and IX in annex II of *Port development: A handbook for planners in developing countries* (second edition), UNCTAD, TD/B/C.4/175/Rev.1.

[17] Therefore, it will be similar to what economists call a free good, that which has zero cost, like air, because of this feature, free goods tend to be used wastefully.

future. Therefore, a minimum price, higher than that suggested by the variable or marginal cost, must be set to ensure efficient behaviour of users. When levels of utilization are extremely high, congestion builds up and users find that using the facility is very expensive in terms of costs of delays experienced and therefore they will abandon it. To avoid reaching this point, the price must escalate with the level of asset utilization, or else during peak periods surcharges have to be introduced.

59. Performance-based pricing can also be applied to encourage users to follow efficient practices while occupying the facility. For instance, by offering rebates from the published tariff to those ships that start to work, say, one-hour after berthing and by applying surcharges, or fines, to those that start after, say, three hours, an incentive is given. Again, any assessment of what could be regarded as an efficient time for performing a particular activity should be made by experienced managers.

60. The principal performance-based tariffs are for berth hire and transit storage. The rates for berth hire are set to encourage rapid turn-around at the berth and thus high berth productivity. The charging unit for berth hire is metre-hours, computed as the length of the vessel multiplied by the hours that the vessel is at the berth. If berth occupancy is low, the unit of time may be aggregated to shifts or days. If the port has only a few berths, then the unit of length may be changed from metres to a berth. The berth hire charge may include seasonal surcharges, congestion surcharges, and performance rebates. The unit of differentiation distinguishes among the berths by their alongside depth, backup area, cargo-handling capabilities and other characteristics. Separate tariff categories may be used to distinguish differences among terminals.

61. Performance-based tariffs for transit storage need to take into account the features of this activity. First, cargo owners in the course of their business undertake temporary and long-term storage, or warehousing; temporary transit storage in ports can serve both purposes. As far as they are interested in warehousing, they are biased in favour of utilizing the port facility as much as possible to the detriment of its optimum utilization as a temporary transit storage. This tendency should be resisted, by taking into account that the willingness of cargo owners to pay for transit storage depends on the cost of storing the cargo in warehouses outside the port as well as the cost of the double-handling associated with transferring the cargo between the transit storage and a warehouse. Secondly, the aversion of cargo owners to congestion is less pronounced than that of shipowners; this may lead to difficulties in finding an acceptable optimum level of utilization. It is true that congestion brings losses and damaged cargoes but as cargoes are more divisible than ships and there are numerous cargo owners, the shifting of cargo, unsuitable stacking heights and other unorthodox practices are resorted to before a congestion point absolutely unacceptable to cargo owners in general is reached.

62. Transit storage tariffs are more complex in order to cater for the above features. They include four parameters: free time, initial daily rate, rate of escalation in daily charges and intervals between escalations. These parameters are adjusted to meet specific operating objectives, as follows: (i) the free time for dutiable cargo should be sufficient to allow efficient importers to clear their cargo without incurring demurrage or storage charges; (ii) the free time for non-dutiable cargoes should allow for receiving of outbound cargo and delivery of inbound cargo over a long enough period to prevent peaking of arrivals of land transport; (iii) the level of charges should be sufficient to maintain an average level of occupancy which is close to the nominal capacity; (iv) the escalation in charges should be sufficient to prevent the use of this storage for long-term warehousing.

63. The development of an effective transit storage tariff requires knowledge of the distribution of cargo dwell times. When there is a large proportion of long-term storage, then the rate and frequency of escalation must be increased. When the dwell times are reasonable but occupancy exceeds the nominal

capacity, then the initial rate must be increased. The temporary storage rates are set so as to minimize cargo dwell time and maximize throughput. The charging unit is the amount of storage occupied multiplied by the period of storage measured in days. The area or space occupied would be the appropriate measure of the amount of resource used, but this is difficult to determine. Moreover the cargo owner does not reserve a specific space but only the space required for the amount of cargo stored. Therefore, the quantity of cargo, as reported in the shipping documents, is used as the charging unit. The unit of differentiation breaks the dwell time into different periods to allow for rate escalation. Separate tariff items or categories are used to distinguish between open and closed storage and among the different types of cargo, i.e. liquid and dry bulk, container, and breakbulk. For containers, the unit of measure is the TEU; the unit of differentiation distinguishes between loaded and empty boxes, but separate tariff items are used to distinguish among types of box, e.g. reefer boxes which require electrical connections, etc., and the direction of movement, e.g. import, export and transhipment. For empty containers, the charging unit may be the number of boxes over a limit determined for each shipping line (that is the dwell time is not important but rather the total number of boxes is).

Value-based pricing

64. Value-based pricing focuses on the value added to the activities of the users from the services and facilities provided by the port. This value added comes from two sources: first, the use of general services and facilities; and, secondly, the use of specific services. Accordingly, the tariffs amenable to this approach are those of a general nature, such as dues, but also relevant is a portion of the tariffs for specific services, such as towage or stevedoring. The latter will, therefore, be split into two parts, one cost-based and the other value-based. Value-added pricing aims to generate enough revenues to cover all costs incurred in providing services and facilities, including those not covered at the time of setting a variable cost-based tariff for services. Finally, it allows management to generate the revenues needed to maintain the existing competitive advantage, or to achieve a new one by generating additional funds.

65. The value added to users' activities is estimated through their willingness to pay a price for a service or a facility, or more specifically, on their reactions to changes in that price. The latter is well known in economics as the price elasticity.[18] For tariffs of general nature, it is reasonable to expect that changes in the tariffs levels have the same impact on all users so that they will experience a similar loss as a result of an tariff increase. This is consistent with the principle of equitable treatment of users of a public service.

66. For tariffs of a general nature, the increase in port charges should thus result in equal reductions in demand for all categories of cargoes or vessels. This is achieved through increases in the tariff level that

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[18] The definition of this concept is as follows: the percentage change in the quantity of the service or goods demanded due to a percentage change in the price. For instance, if the original quantity demanded is 100 units and the price is US$ 12 per unit, and a change in price to US$ 15 causes the demand to fall to 90 units; then, the percentage change in price is 3/12 = 25 per cent, and the percentage change in quantity is -10/100 = -10 per-cent. Therefore, the elasticity is -10/25 = - 0.4. The minus sign signifies that an increase in price has lead to a decrease in quantity.

are proportional to the inverse of price elasticity.[19] The higher the price elasticity, the more sensitive volume is to a change in price, and the lower should be the increase in charges. For example, if the volume of import cargo shipped through the port is divided into three groups with price elasticities, with respect to their CIF value, of -1.0, -1.5 and -2.0 respectively, then the increase in the charges would also be proportional to their CIF, and the increase corresponding to the first group would be 1.5 times the increase corresponding to the second group or twice the increase for the third one.[20] Specific marketing objectives can modify this equitable treatment of users by distinguishing between those trades which the port wants to promote and those which are not of interest. The case for having the same equitable approach for specific tariffs is less convincing, as costs are indeed incurred in the provision of specific services. However, marketing objectives, or the need to build up reserves for developing competitive advantages, may dictate otherwise.

67. Estimates of price elasticity, made in order to set a value-added tariff require specialized knowledge from the marketing departments. Nevertheless, port managers can gain an insight into the likely outcome of this specialized work by taking stock of the reaction of clients to changes in tariffs, as discussed previously (paragraph 27).

68. In general, the volume of individual commodities internationally traded depends heavily on the difference in the price offered to the producer, or shipper, and that charged to the consumer or consignee. An exporter in competition with a number of suppliers from other regions and/or nations will have a trading range over which he can deliver goods at a competitive price, determined by the logistics cost. However, the demand at a specific location will depend on the CIF price; therefore, the price elasticity should be measured with respect to the CIF price rather than the logistics cost, and the changes in port charges should be computed as a percentage change in the CIF price. For an importer competing with local producers of substitute goods, price sensitivity will depend on the similarity and availability of substitute goods and the delivered cost relative to the prices of these goods. Any increase in port charges must be compared to the CIF price of the cargo as well as to the degree of competition. Because importers usually face less competition than exporters, imports are generally less price sensitive.

69. The basic decision of importers and exporters on which route to use depends on their logistics costs. These costs comprise not only port charges and tariffs for the various modes of transport used, but also the availability and price of intermediate storage along the route, the number of transfers and handling required, the potential losses and damages incurred, the time for the door-to-door movements, and the reliability of delivery times. Shippers generally choose the least cost route; if the difference in costs is not large, they are reluctant to change to a new route. Any change would require establishing new

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[19] The use of prices proportional to the inverse of the price elasticity is commonly known as Ramsey pricing, a theory originally developed to provide a tax structure that would minimize the loss to the economy resulting from the collection of taxes. It is named after Frank Ramsey who in the 1920's demonstrated a method of taxation that minimized the loss of social welfare resulting from the additional revenues raised. For a discussion of this approach along with the mathematical derivation, see "*Ramsey Pricing in the Presence of Externality Costs*", Tae Hoon Oum and Michael W. Trethway, *Journal of Transport Economics and Policy*, September 1988.

[20] Ramsey pricing indicates that increases for the three groups will be in the following proportion 1/1.0, 1/1.5 and 1/2 respectively. Therefore, an increase of US$ 1 for the first group corresponds to a respective increase of US$ 0.67 and US$ 0.50 for the second and third groups. This is equivalent to saying that the increase of the first group is 1/0.67 = 1.5 times the increase of the second group or that is 1/0.5 = 2 times the increase of the third one.

business relationships and informing clients of the new shipping arrangements and schedules. Such factors reduce price elasticity with respect to logistics costs. The same principles apply to the choices of those modern container transport operators which decide on the routing of cargoes on behalf of shippers.

70. The basic decision of vessel operators is which ports to call at and how often. This decision depends on the costs to call at the port, which includes all port charges, the expected turn-around time in port and the cost of diverting the vessel from the main trading route. It also depends on the availability of cargo, the level of competition for that cargo, and the freight rates to be obtained from this cargo. These revenue considerations influence the behaviour of the vessel operators to changes in the costs of a port call. An increase in port charges should be measured as a percentage increase in the total cost of a port call. The behaviour of liner operators having their own terminals takes other corporate objectives into consideration.

71. Accurate measurements of elasticities are not possible but broad estimates of relative values of price elasticity can be obtained through a general review of the competitive environment in which the port users operate and from the port's experiences in serving particular markets. More precise estimates such as price elasticities, of the cargo transferred through the port or the vessels calling at the port, with respect to port charges are not possible because other more important factors affect these volumes. Even the measurement of elasticity with respect to the delivered price of the commodities is difficult because of such factors. In addition, there is a lag between the change in price and the adjustment of traffic volumes and this adjustment is different in the short term and the long term.

72. However, the responses of port clients to changes in the following elements can serve as a basis for differentiating among commodities, trade routes and shipping services as to their relative price sensitivity. They are: (i) the tariffs of the port and its competing ports; (ii) the quality of service provided in the port and competing ports; (iii) the costs for competing routes with different land and ocean freight rates; (iv) the FOB/CIF prices of the major commodities handled; and (v) the regional trade in specific commodities and cargo volumes on specific routes. Three categories of elasticity could, for example, be defined as follows. With a 20 per cent increase in the price of a commodity or the cost of transport services, the volume of traffic would decline by:

High elasticity	-	25 per cent or more
Medium elasticity	-	more than 15 per cent but less than 25 per cent
Low elasticity	-	15 per cent or less

The value-based tariff would then be changed so that the port charges for each group would increase by a proportion of their value equal to 0.8X, 1.0X and 1.33X, respectively. [21] The value of X would then be set to meet the revenue target for this tariff.

73. Specific marketing objectives can also be targeted in this process, by assigning different tariff increases to commodities or trades in accordance with the forecasted change in the port's market share. An example is indicated in table 9 where each commodity or trade is assigned to a cell. Value-based tariffs would be determined by multiplying the value of the commodity, or cost of the transport, by the factor in that cell and by a revenue constant. This constant would equate the revenues from the tariff with the specified revenue target.

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[21] Assuming that the volume decline for the three groups is 25, 20 and 15 per cent, respectively, then the elasticities are -25/20 = -1.25; -20/20 = -1.0 and -15/20 = -0.75. The proportions from the Ramsey pricing are: 1/1.25 = 0.8; 1/1 = 1.0 and 1/0.75 = 1.33. Therefore, the equivalent to a rise of 1.00 in the second group is a rise of 0.8 in the first group and of 1.33 in the third group.

Table 9
Relative value-based tariffs as a percentage of the value of the cargo or the transport

	Marketing objectives		
Price elasticity	Increase share	Maintain share	Decrease share
High (>1.25)	0.60	0.80	1.00
Medium (.80-1.25)	0.75	1.00	1.20
Low (<.80)	1.00	1.25	1.50

74. The impact of these changes on the volume of cargo can be extrapolated with reasonable accuracy from the current level of demand if the increase is not too large.[22] For large increases, the results are much less certain. They are even more uncertain for completely new trades or services, where there is no precedent from which to project the price-demand equilibrium.

75. The most common value-based tariffs are port dues on ships and on cargoes. Port dues on ships are based on the type and size of the vessels. They are used to cover the costs of maintenance of the waterside infrastructure, exclusive of wharves, and for maintenance dredging. They may also include the capital cost of any waterside infrastructure not treated as a sunk cost or as public infrastructure and to recover a return on investment or establish reserves for development. They can also be used to cover the fixed costs of towage and pilotage. This tariff is based on the value to the ship operator of calling at the port. The main factor taken into account is the potential earnings from this port call which is compared to the daily cost of the vessel. As the latter is proportional to the vessel's size and its principal cargo (i.e. dry bulks, tanker, container, general cargo), then the unit of differentiation should be the type of vessel and the charging units would be the carrying-capacity of the vessel as measured in GRT, NRT, DWT or some combination of length, beam and draft.

76. Port dues on cargoes are used to cover the costs for development and maintenance of land-side infrastructure. They may also help offset the fixed cost for equipment and labour used for cargo handling. In addition, they can provide the additional revenues needed to cover common costs. The value of transferring cargo through the port is related to the value of the cargo. The charging unit can be the monetary value of cargo, as measured in terms of CIF/FOB value, with the unit of differentiation based on the direction of movement, e.g. import, export and transhipment. Alternatively, the charging unit can be the quantity of cargo measured in weight or volume, with the unit of differentiation based on the type of commodity. Commodities would be grouped according to their average value per unit of measure.

77. The effectiveness of value-based tariffs depends on how successfully the structure of the tariffs differentiates among potential users. Separate tariffs for containers, breakbulk, liquid bulk and dry bulk cargoes can be used to differentiate among cargoes according to their value and price sensitivity. Alternatively, differentiation can be accomplished within a tariff category by having each tariff item apply to a different group of port users. Finally, the unit of measure for a tariff item can be selected to provide

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[22] This procedure is a more analytical approach to the common practice of port management to increase all tariffs by a specific percentage in order to generate a specific amount of additional revenue. The percentage is then adjusted for the individual tariffs according to the expected or actual reactions of port users.

a surrogate measure of the port users' willingness-to-pay. However, setting value-based tariffs can result in profitable cargo being attracted to neighbouring ports which use cost-based tariffs. Value-based tariffs using the monetary value of cargo as the charging unit will often require a system to check the value of the cargo, for example, physical inspection, that can reduce port performance.

IV. CONCLUSIONS

78. Strategic pricing is a good tool for helping ports achieve competitive advantage. Its use should take into account the objectives and targets of the port authorities and other corporate bodies active in ports. The need for strategic pricing is proportional to the degree of competition facing the port from neighbouring ports and to that within the port among providers of services. Strategic pricing presupposes a proactive attitude on the part of the port authority and the will to understand the clients' needs. Charges should be viewed not only as a way of increasing revenues, but also of improving the utilization of port facilities, attracting traffic and, where relevant, decreasing per-unit costs.

79. Strategic pricing in ports is reflected in a new approach to setting port tariffs, namely the CPV approach (Cost - Performance - Value). One of these three elements thereby determines the level of charges within the scope of specific objectives and constraints of the corporate body. The approach is useful for individual ports; within ports the CPV approach can guide the authority and operators, but it cannot be used by a national port authority to set a nationwide port tariff. One of the key assumptions of the CPV approach is that cost alone should not determine the level of tariffs. Obviously, in the long-run the average cost needs to be used in setting those levels, particularly in those ports for which subsidies are not available. However, as the fixed costs are a large portion of total costs in modern ports, the commercial objectives should be to seek ways to recover them in the short run. This means using cross-subsidies between categories or tariff items. More specifically, it is necessary to sensitize managers to the clients' perceptions of the value of services rendered. An inside and outside effort of the port authority is required to implement the CPV approach in a process of tariff revisions.

80. Ports are being forced to become financially sustainable. Therefore, an exact evaluation of their expenses is needed so as to allow them to set appropriate tariffs. A foundation for pricing is thus a cost accounting system that allows the port to record and monitor all costs. As ports become more accountable for their financial well being, they also need to be given autonomy for setting tariffs. When central approval is necessary there is often a considerable time-lag between an application for a price increase and the granting of the necessary permission, this can lead to an underpricing of costly infrastructure facilities. Where privatizing services or infrastructure are under consideration, regulatory bodies must allow the operator to set prices that provide a fair return on the investment. However, there may be a need for control by the port authority to avoid high tariffs based on high profit or inefficient operation, particularly if there is not sufficient choice for port users or alternative ports available.

81. Over the long run, management must set prices to cover the port's capital and operating costs unless it is government policy to provide a subsidy. A key issue is whether the infrastructure is considered part of the nation's assets or wealth. If it is, a corresponding portion of the infrastructure costs may be covered by the government rather than by the port authority and hence may not be considered to be a subsidy. A decision on such a question will obviously have an impact on the tariff levels set by the port authority, as the authority may or may not have to cover this cost.

ANNEX

Checklist of tasks to establish a new port tariff

1. Define pricing period over which tariffs will be calculated;
2. Define facilities and services to be charged for;
3. Identify users of each of these facilities and services;
4. Identify the nature and extent of any constraints which affect the pricing process;
5. Establish projections of demand for facilities and services over the pricing period;
6. Define the objectives of the pricing system and the way in which they affect the capacity to raise revenue from any group of users;
7. Select a reference year for which a first estimate of port charges will be calculated;
8. Establish cost and revenue centres defined so that they can be clearly related to each other;
9. Define a pricing structure (type of charge, basic unit);
10. Calculate annual costs;
11. Calculate the minimum annual flow of revenue required in the light of constraints and objectives, including the possible need to provide funds to cover the cost of new investments;
12. Determine, by an iterative process, the set of charges that satisfies all the necessary conditions, first for the reference year and then for the pricing period as a whole for any year;
13. Test the new set of port charges, over a trial period alongside the existing charges.

This summary checklist was proposed in the earlier UNCTAD port pricing study and still serves as a valuable guide for revising tariffs. Obviously the objectives of the pricing system must be related to the strategy of the port. An important task is the estimation of future levels of traffic as it will determine the total revenue generated. Many variables beyond the control of the port, including the future performance and prices of the port facilities and services will affect the future traffic. As fixed costs are often a considerable portion of the total costs, traffic levels will consequently have a major effect on pricing levels.